Name: _____
Date: _____
Flynt- _____ Period
___th Grade Science

Five Ways the Atmosphere Protects and Supports Life on Earth

1. The atmosphere contains important gasses like nitrogen, oxygen, water vapor, and carbon dioxide that living things need to survive.
   - Carbon dioxide is needed in order for plants to carry out photosynthesis.
   - Oxygen is required for almost all organisms (plants and animals) in order to carry out cellular respiration.
   - Nitrogen is needed by all organisms to grow and repair body cells.
     - ~ Nitrogen from the atmosphere is "fixed" by bacteria in the soil so that it can be absorbed by plants and enter the food chain.
   - All living things (that we know of) require water to survive.
     - ~ Many processes, including photosynthesis, require water as a reactant.
     - ~ Cells are made primarily of water.

2. Most meteors burn up in the atmosphere before crashing into Earth's surface.
   - Chunks of rock from outer space are called meteoroids.
     - ~ Sometime meteoroids get pulled towards Earth by Earth's gravity.
   - Meteoroids that are falling through the Earth's atmosphere are called meteors or shooting stars.
     - ~ Meteors falling through the atmosphere burn up due to friction with atmospheric gasses, NOT due to temperatures in the atmosphere!
       - ▪ Meteors don't start burning up until they hit the mesosphere; above this layer, the low density of atmosphere cannot generate enough friction to cause combustion.
   - Meteors that don't burn up entirely before reaching the ground are called meteorites.
     - ~ Does not happen often.
     - ~ How would life on Earth be affected if more meteorites did reach the ground? (Margin notes question!)

3. Ozone and other gasses in the atmosphere help to block dangerous radiation from the sun.

- When radiation strikes a particle of matter, one of the following things can happen:
  - ~ Transmit/Transmission – radiation travels or passes through.
  - ~ Reflect/Reflection – radiation bounces back in the direction it was coming from.
  - ~ Refract/Refraction – radiation is bent and travels on in a new different direction at a different speed.
  - ~ Absorb/Absorption – the radiation (light) energy is changed into heat/thermal energy.
- Ozone (O_3) is structurally and chemically different than regular molecular oxygen (O_2).

- Ozone located in the **stratosphere** (in the **Ozone Layer**) absorbs UV radiation, causing the ozone molecules to emit heat energy, warming the gasses around them.
  - ~ The absorption of UV radiation by ozone is why temperatures increase in the stratosphere!
  - ~ Ultraviolet radiation that makes it to the surface can cause skin cancer and eye damage, so the ozone layer is VERY important to living things!
- Tropospheric ozone is considered a **pollutant** and can be harmful to living things!
  - ~ Leads to the phrase: **"Good up high, bad nearby!"**
  - ~ Can be especially harmful for senior citizens, children, and people with heart and lung conditions such as emphysema, bronchitis, and asthma.
    - Ozone can inflame breathing passages, decrease the lungs' working capacity, cause shortness of breath, pain when inhaling deeply, wheezing, and coughing.
    - Ozone can cause eye and nose irritation, and it dries out the protective membranes of the nose and throat.
    - Ozone also interferes with the body's ability to fight infection, increasing susceptibility to illness.
      - ❖ Hospital admissions and respiratory deaths often increase during periods when ozone levels are high.

- ~ There is evidence of significant reduction in agricultural yields because of increased ground-level ozone and pollution, which interferes with photosynthesis and stunts overall growth of some plant species.
- ~ Most tropospheric ozone forms when sunlight hits various pollutants in the air and forming **photochemical smog**.
  - Very common in large cities or downwind from large cities in dry climates and in valleys surrounded by mountains (geologic basins).
- ~ The atmospheric lifetime of tropospheric ozone is about 22 days.

4. The atmosphere is often said to "act like a blanket", trapping heat and keeping Earth's surface warm, even at night. ⇒ **GREENHOUSE EFFECT**!!!

- Greenhouse gasses as those gasses atmosphere that absorb radiation from the sun and re-emit that radiation as heat (changes from light energy to thermal "infrared" energy).
  - ~ Carbon Dioxide (CO_2)
  - ~ Methane (CH_4)
  - ~ Nitrous Oxide (N_2O)
  - ~ Ozone (O_3)
  - ~ Water Vapor (H_2O)
- **The greenhouse effect is not a bad thing!** If we did not have the greenhouse effect, the average temperature on the Earth's surface would be about -18°C (0°F), which is well below freezing!
  - ~ Average temperature increase caused by the greenhouse effect: 33°C (59°F).
  - ~ Comparative meteorology:

Temperatures on the Moon

Where the Sun is shining, the Moon's temperature rises to 230°F and where it is dark falls to negative 290°F. The average surface temperature of the moon, which is about the same distance as the Earth from the Sun, is also near 0°F, but of course, the moon has no atmosphere! By contrast, the average surface temperature of the Earth is 60°F at sea level. On Earth, the contrast between maximum and minimum temperatures would not be as great as on the Moon, even without an atmosphere, because the Earth rotates once in a day, while the Moon only rotates once in a month. However, without an atmosphere the Earth's contrast between day and night and the contrast between summer and winter would be very large indeed.

  - ~ What would surface temps be like without our atmosphere (without the greenhouse effect)?

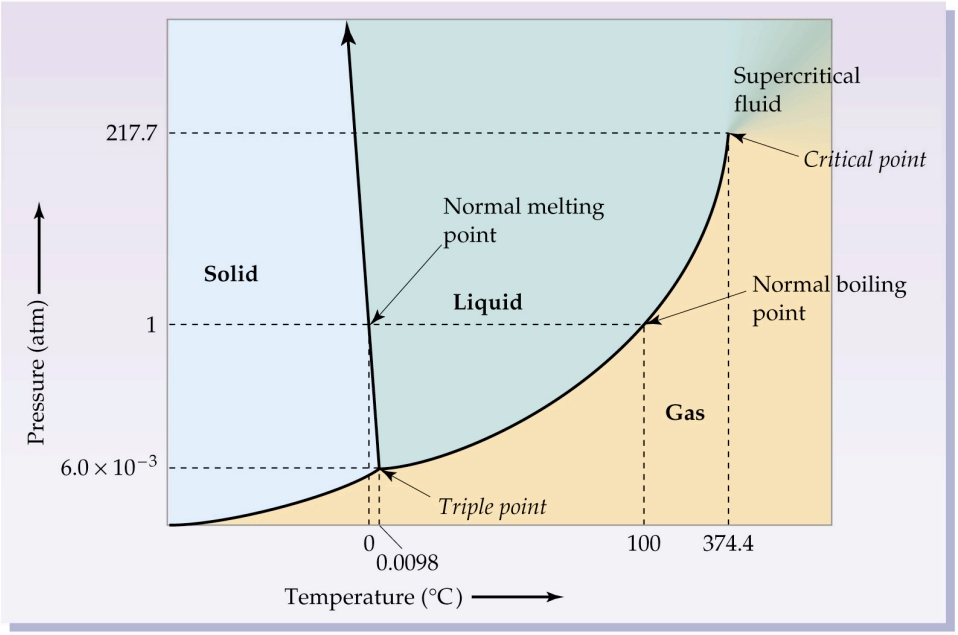
Remember: CO2 is a greenhouse gas!

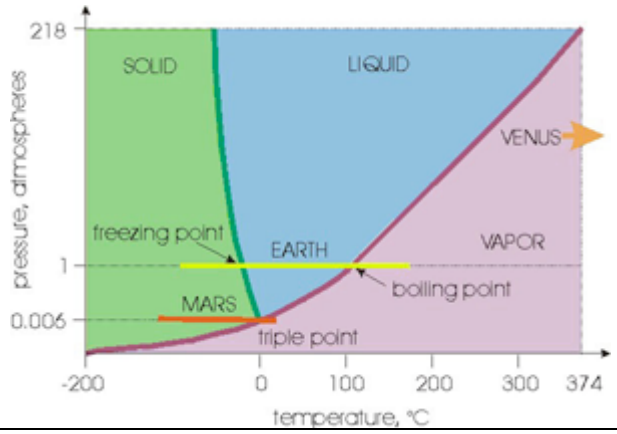
- The theory of **Anthropogenic** (an-throw-poh-jen-ick) **Global Warming** states that human activities are increasing the amount of CO_2 in the atmosphere.
  - ~ While Earth's climate has changed many times throughout its 4.7 billion-year history, the Theory of AGW focuses on the causes of and the potential consequences that a ***relatively rapid change in climate caused, at least in part, by humans*** could have on the world's ecosystems.
  - ~ Humans burn vast amounts of **fossil fuels** and **biofuels** in power plants and automobiles, releasing CO_2 into the atmosphere.
    - Around 1750, the concentration of CO_2 in the atmosphere was about 275 parts per million. Today, the concentration is 387 parts per million, which is a 30% increase.
    - Since the last half of the twentieth century, the **rate** of this increase has risen sharply and is currently about 3% per year.
  - ~ Increasing the amount of greenhouse gasses in the atmosphere should amplifies **greenhouse effect**, making the Earth warmer.
  - ~ The clearing of forests for agricultural purposes and human development diminishes "Mother Nature's" ability to naturally remove CO_2 from the atmosphere.
    - When these forests are cut, they are usually burned, adding even more CO_2 to the atmosphere!
- The relationship between the greenhouse effect and AGW is perhaps best stated as *"too much of a good thing!"*

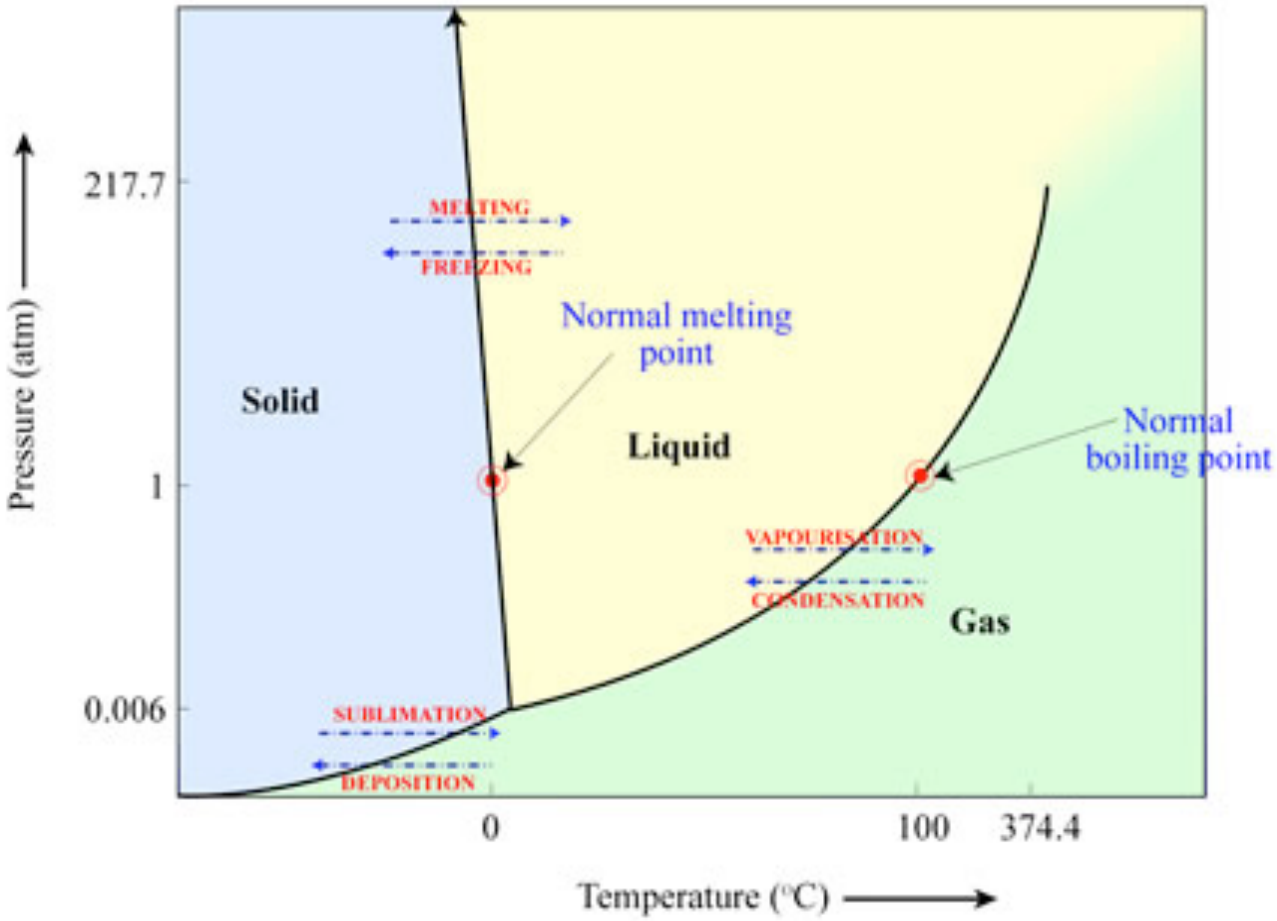
5. Water in all three phases is critical on our planet! The atmosphere keeps Earth's surface warm (the right **temperature**) and provides the right amount of **atmospheric pressure** to allow water to exist as a solid, a liquid, and a gas on Earth's surface.

- Air pressure is the force produced by the gas molecules in the atmosphere.
  - ~ Atmospheric pressure is a function of the height and density of the atmosphere, which is related to a planet's gravitational field.
  - ~ At sea level, Earth's atmosphere pushes with a force of 1013 millibars. On Mars, surface pressures are typically in the range of 6.8 millibars.

- Whether water exists as a solid, liquid, or gas depends on its temperature and the pressure of the surrounding environment. **Both pressure AND temperature affect phase changes!!!** Change the temperature or pressure, and water may undergo a phase change!
  - ~ Water freezes at 0°C and boils at 100°C ***if and only if*** the air pressure is exactly 1 atm (which is the pressure at sea level on Earth).
  - ~ You can raise the boiling temperature of water by increasing the pressure above the water.
    - To vaporize in the pressurized container, the water molecules need to increase their kinetic energy. This increase in kinetic energy translates into a higher boiling temperature.
  - ~ What is the result of reducing the pressure?
    - With a reduced pressure, the water molecules need less kinetic energy to vaporize than they do in an open container. This decrease in kinetic energy translates in a lower boiling point.






Pressure (atm)
217.7
1
0.006
MELTING
FREEZING
Normal melting point
Solid
Liquid
Normal boiling point
VAPOURISATION
CONDENSATION
Gas
SUBLIMATION
DEPOSITION
0
100
374.4
Temperature (°C)